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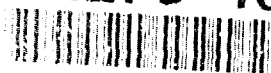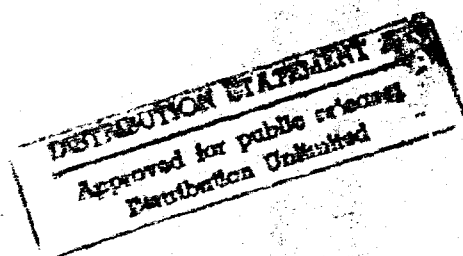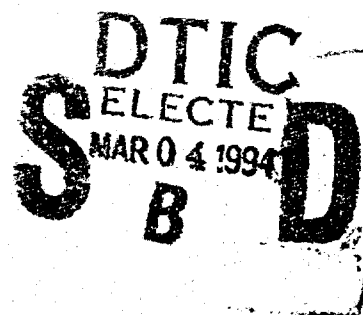
Training Strategies for Users of Automated Compliance Management Systems

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Army training for automated system user groups has typically consisted of off-site training with its associated travel, lodging, and other per diem costs. Classroom instruction off-site deprives an installation of the services of personnel while they are receiving the training. That is a serious problem for Army Reserve and National Guard personnel, given their limited availability for training away from the installation to which they are assigned. Such instruction is also expensive.

Using the training required for the Army Compliance Tracking System as a model, we have developed a training strategy matrix that allows us to select a training model that meets the individual user's specific training needs. That matrix can be adapted to other automated compliance systems. We have also identified cost factors associated with each of the training techniques, such as off-site training, correspondence course, and technology-based training.

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LOGISTICS MANAGEMENT INSTITUTE

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Executive Summary

In its efforts to comply with an array of Federal, state, and local environmental laws and regulations, the Army has developed automated methods for collecting, analyzing, and monitoring environmental information to use in evaluating and properly managing environmental programs. Both current and proposed automated compliance management systems require installation personnel training. A typical user group can consist of data entry personnel, functional specialists, environmental program managers, and their major Army command counterparts. An installation commander may also have to receive orientation training on the purpose and capabilities of an automated compliance management system since the products of such a system can be used to evaluate the installation's compliance status.

In the Army, training for automated system user groups has typically consisted of off-site training with its associated travel, lodging, and other per diem costs. Classroom instruction off-site deprives an installation of the services of personnel while they are receiving the training. That is a serious problem for Army Reserve and National Guard personnel, given their limited availability for training away from the installation to which they are assigned. Such instruction is also expensive.

As its resources become more constrained, the Army needs to identify and evaluate alternatives to off-site training. One general approach is on-site, low-technology training such as that received in correspondence courses. Another approach is technology-based training.

Technology-based training, especially with methods that stress a high level of interaction, can be substituted for traditional classroom training and can produce the quality of training necessary to enable selected user groups to operate automated compliance systems effectively. The selection of alternative training techniques depends on the user group requiring training, since personnel skills and training goals and objectives tend to drive the decision-making process.

Using the training required for the Army Compliance Tracking System as a model, we have developed a training strategy matrix that allows us to select a training model that meets the individual user's specific training needs. That matrix can be adapted to other automated compliance systems. We have also

identified cost factors associated with each of the training techniques, such as off-site training, correspondence courses, and technology-based training.

We recommend that the Army review the value of the proposed training methods for both current and newly fielded programs. In addition, the Army should place added emphasis on the use of embedded training (i.e., training included with the system as a tutorial) as a means of including training in the design phase of new automated systems.

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CHAPTER 1

The Need for Automated Data System Training

During the initial fielding of the Army Compliance Tracking System (ACTS), the Army developed a training program to facilitate the integration and use of the system by the installation and major command environmental staff. The training was conducted at a centralized location and focused on hands-on data entry. A cross section of personnel within the organizational structure of the Army's environmental program attended the initial voluntary training programs.

At the completion of the training, a course critique was requested from all attendees. The responses spread across a wide range of topics and concerns, but a common concern was that no information was provided on how to use ACTS data for management decision-making. The training did not address why information was needed, what decision-making outputs the system could provide, or how the system could be used to assist in compliance with environmental regulations.

As a result of the response from this initial training phase, the Army Environmental Center (AEC) determined that a strategy was needed for selecting and designing training programs for automated data systems. The strategy would be based on using the most cost-effective training method for particular duty functions. The Logistics Management Institute was asked to identify the general training methods available; their strengths, weaknesses, and relative costs; and the most appropriate training modes for different types of users.

CHAPTER 2

Personnel and Organizational Roles and Responsibilities in Automated Data Systems

The development of automated data systems (ADSs) has changed the way data are collected and interpreted. Large amounts of data can now be imported, aggregated, and manipulated quickly and effectively, vastly reducing the potential for human errors (especially computational) that once existed. ADSs have become an integral part of program and organization management.

To employ ADS capabilities effectively, the data must be accurate and managers must understand how to use the data properly. Thus, both managers and operators need to know the capabilities of the systems. Whether the systems are newly fielded or already in use, training programs need to address the specific needs of personnel at all levels of the organization.

CONVERSION OF RAW DATA TO USABLE INFORMATION

Information for an ADS originates from events at Army installations. A coding system is used to record those events as raw data, which must then be imported into the ADS. The ADS then assembles the raw data into information that can be used to make decisions.

At the initial stage, when the data are in a raw form, no data manipulation should be necessary; in fact, the operator should not make judgments or invoke processes at that point. Rather, the operator should perform only the primary data-entry task. The operator's job is to move swiftly through the data-entry screens and input the data quickly and accurately. Operators should not have to be programmers to operate the system.

The raw data become information when they are aggregated with other data to provide a description of a situation from which impressions can be formed, comparisons developed, or decisions made. That information is useful to management personnel in guiding organizational activities. The transition of raw data into usable information is a fundamental process (indeed, the primary purpose) of ADSs. An understanding of the data flow is necessary in identifying and developing human roles in the collection, input, and processing of data by ADSs.

Personnel Roles and Responsibilities[1]

The ADS comprises two basic types of components: the physical component, which consists of the software and hardware, and the human component, which includes the operators of the system and the users of the system-generated information. The physical component is the mechanism by which the data are processed, but it is heavily dependent on the actions, knowledge, and abilities of the ADS human component. A significant limiting factor to the effectiveness of the ADS is the capability of the human component.

The human component collects and inputs the data. Those two actions are the most fundamental processes in the system. If they are not accurate and effective, even a finely designed ADS will have little value.

As data are processed through the ADS and transferred through the hierarchies of the organization using the ADS, modifications (chiefly aggregation) occur. It is important for users and managers to understand both the source and context of their data, especially when those data have been reduced in form. Thus, the intent, use, and handling of the data in and by the ADS must be clearly understood by users and managers at all levels. Market-tested computers aggregate or represent information accurately in terms of the instructions they are given; the role of data-dependent managers is to ensure that the display or aggregation is not misleading, inappropriate, or poorly conceived and that data-entry operators provide current data to the system.

In its development, an ADS must be defined with respect to the organizational structure it supports because it is designed to be maintained and used by designated personnel in specific organizations for defined purposes. Despite that essential requirement, most organizations and ADSs share a general organizational setting and structure, and the human components can be treated generically here. (In Chapter 4 we describe specific applications of the Army's use of ACTS.)

The human component in most organizations that use ADSs consists of personnel in a variety of roles ranging from data-entry operator serving a technical role to managers serving a strictly conceptual purpose. Among the many positions, five stand out as typical: data-entry operator, functional specialist, functional manager, data system administrator, and project manager.

Data-Entry Operator

The most purely technical role in automated systems is performed by the data-entry operator. That person operates the physical components of the ADS and performs the data entry, queries the system, archives the imported/

[1]This outline of functional roles is developed in more detail in LMI Report AR202RD2, *Quality Assurance and Quality Control of Automated Data Systems*, Douglas M. Brown, Paul Koshetar, Jr., and Robert W. Salthouse, September 1992.

aggregated information, and generates the necessary reports. Should improvements be needed to the physical components, data-entry operators are the best source of information on the details and idiosyncrasies of the ADS. They are the hands-on personnel in the ADS hierarchy, and they must be able to perform their required ADS tasks swiftly and effectively.

Functional Specialist

The next level of data sophistication within the organization is found among the functional specialists, who are typically subject-matter experts. They are the first point of interaction with the ADS because they must observe and record real events to provide the data entered into the system.

Functional specialists need to access or review data within the system to make program recommendations to the functional managers; thus, they must be capable of interpreting the data and be familiar with the data processing capability of the ADS. In addition, the data in the system must be reviewed to ensure their accuracy. The functional specialists, as subject matter experts, are a critical link in the quality-control process. If inaccurate data are entered into the system, eventually decisions will be based on spurious data.

Functional Manager

Functional managers are responsible for the successful execution of the organization's mission. They can be responsible for managing the functional specialists within multiple program areas or in a single area. They may not, in fact, be proficient in the specific functions being addressed by the ADS: the functional specialist provides expert resources and information.

Functional managers are concerned with the information that the ADS can provide (through manipulation of that data) to help them make management decisions rather than with the specifics of the data in the system. To use the data effectively, they must understand the capability of the ADS to provide and analyze information and (where applicable) its capacity to import and export data from other sources. They must also manage the resources that go into creating the data base and its outputs. They must manage the resources that use the ADS, ensuring that sufficient time is allotted to perform these functions and ensuring that the functions are, in fact, performed. In focusing attention on the data that provide managerial information, managers serve as the primary source of quality assurance for the data going into the ADS and the information being generated as output.

Data System Administrator

Specialized participants in the ADS operation are the data system administrators. They are technical experts who support the system, often controlling a staff of data system technicians and programmers. Data system administrators may have little or no knowledge of the functional areas; system data and output requirements are taken as "givens" from the project manager or the supported functional manager. The administrators support managers by designing, testing, fielding, maintaining, and upgrading the data system (to the degree appropriate to the organizational level) to meet the managers' information needs.

Project Manager

Project managers are staff-level action officers who have been assigned responsibility for the ADS as a product by itself. That is, they do not necessarily use the data to manage functional programs; they facilitate the use of the data by identifying user needs and giving technical direction to the system administrators. Thus, the responsibility of developing, fielding, maintaining, and improving the ADS falls to project managers. They must have a general knowledge of the functional areas and of technical issues associated with data system programming and management to provide system interpretations for the users and functional direction to the programmers.

ORGANIZATIONAL ROLES AND RESPONSIBILITIES

Apart from the distinctions described in the previous subsections, these various roles are modified by the users' organizational structure, which may range from "street-level" customer-serving offices to corporate offices overseeing only the activities of other offices. To provide a general description, we have defined the principal organizational levels as local, intermediate, and executive. Again, because the roles are essential to the functioning of the ADS, all five roles are found at all levels, but the extent and manner in which each role is performed vary with the level in the organization.

Within the Army environmental context, the local level is represented by the installation staff; the intermediate level covers all the Army major commands (MACOMS), major subordinate commands (MSCs), and other activities between the installations and the executive level; and the executive level comprises the Army Secretariats, the Army Staff, and their various operating agencies.

At each level, the data-entry operator handles the data and other information directly; functional specialists provide insight into the specific content of the data and perform quality control on the data at each specific level; and functional managers make management decisions from the data outputs. System

administrators support the technical needs of the users, and program managers ensure that the ADS is properly implemented.

The level of the user's office within the organizational structure affects the way in which individuals interact with and use the ADS. For example, a data-entry operator at the local level inputs data collected at that location, while the data-entry operator at the intermediate level electronically aggregates data from several local-level data sets and may or may not be required to enter data directly.

Local Level

The first level in an organizational structure is the local level (in the Army, that level is normally either a troop unit staff or an installation staff). The local level of an organization performs the mission of the organization: they are the doers. They manage the daily operations. In the case of a local environmental staff, they are the staff members who are conducting the inventories, overseeing abatement operations, ensuring the compliance, etc. This level of organization provides managerial information, in the form of reports, to the next higher headquarters.

As at all other levels, all roles addressed earlier are present. Functional specialists collect data, which data entry operators input to the physical components of the ADS. Functional specialists perform quality control on the data in the system. The functional managers use the data (through reports, queries and displays) to assess the overall program.

Intermediate Level

Within the Army context, the intermediate level is the MACOM or MSC staff. The role of these organizations is simply to supervise the actions of subordinate (i.e., local level) staffs to ensure that required actions are occurring and reports are submitted in a timely manner. At this level, information is aggregated from multiple local organizations rather than being obtained from on-site observations. Thus, while data-entry operators are used, their role may focus more on file transfer and aggregation than on keyboard entry. Their function requires less proficiency in data entry but a higher degree of comprehension of the ADS operations. In addition, data-entry operators at the intermediate level must be proficient in aggregating information and conducting queries or generating output as required by functional specialists and managers.

Functional specialists at the intermediate level perform quality control on the input from local sources; in essence, by performing a data review, they are in a position to critique the quality-control efforts of local-level functional specialists. Where necessary, they perform the quality control on the data entered by data-entry operators at the intermediate level. Even if the data provided by the local levels are accurate, if the intermediate-level, data-entry operator enters

inaccurate data or inappropriately adjusts the local data, the data base will be in-accurate.

Functional managers at the intermediate level must be able to use aggre-gated data from the multiple local organizations to perform decision-making processes. They require the same knowledge of the ADS as the local-level func-tional managers, but they do not make decisions and assessments in terms of di-rect mission performance ("done/not done") as at the local level. Functional managers measure aggregate performance ("percent complete," or "good enough overall"). The types of information required to support this level of analysis are quite different from those required at the local level.

Executive Level

The final level of the organization is the executive level. Information at this level is aggregated from multiple intermediate levels. In addition to the aggregate-level performance indicators found at the intermediate level, at this level long-term forecasting identifies how factors outside the organization may influence events. Thus, at the executive level, personnel may be more reliant on external (nonmission) information.

At this level, data-entry operators, functional specialists, and functional managers may be found performing the same tasks as described earlier, with some adjustments for the type and focus of work.

In defining the methods appropriate for ADS training, the roles and levels of the individuals to be trained affect the nature of their work and therefore the content of their training requirements. Such issues must be taken into considera-tion, and training needs to be focused on the skills that are needed by the trainee. In Chapter 3, we identify the major methods by which training may be pre-sented; in Chapter 4, we link those training methods with the functions that indi-viduals perform to recommend the most appropriate training alternative for specified roles.

CHAPTER 3

Alternative Training Methods for ADS

The Army's Training and Doctrine Command (TRADOC) has a highly detailed and systematic approach for developing training methods in the Army.[1] In this report, we address a strategy rather than the development of the training material itself; thus, we do not incorporate that stringent methodology. Instead, we review the training methods that are generally available to the Army, consider their advantages and disadvantages, and compare them with the requirements of Army personnel who need the training.

DEFINING A COURSE OBJECTIVE

The initial step in selecting a training method (and again in developing the training material itself) is to define the main objectives of the training. Those objectives can be defined by the answers to three key questions:

♦ Who is the audience?

♦ What tasks require training, and what level of proficiency is needed?

♦ Why is the training needed?

The answers to these questions will also help to determine when, where, and how the training should be conducted.

Unless the training objectives are clearly defined early in the training development process, no method can be expected to provide the desired results. Such unfocused training merely wastes time and resources.

Defining training objectives is essential to identifying the training needs and selecting the appropriate methods of training. The key to effective communication in training is first to identify the target audience, specify the skills they should have already acquired, and then determine training methodologies.

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[1] *The Army Systems Approach to Training,* TRADOC Regulations 350-7, 350-15, and 351-1 and TRADOC Pamphlet 351-13.

FACTORS TO CONSIDER IN SELECTING A TRAINING METHOD

Once the objectives of a training activity are identified, the methods selected should be the most effective possible under existing conditions, cost the least possible to realize the desired effectiveness, and recognize any practical constraints that apply. We defined a number of factors that must be considered when selecting a specific training method, and we show those factors in Table 3-1.

Table 3-1.
Factors Affecting Utility of Training Methods

Utility factors
Effectiveness
Active task versus reading or knowledge skill
High degree of knowledge required at end of training
High degree of audience knowledge or experience
Wide range of audience experience
Need for interactive instruction
Need for multimedia
Need for expert instructor versus exposure to material
Complexity of material
Cost
Development
Operational
Opportunity (personnel time)
Constraints
Length of course
Flexibility of timing
Ability to reschedule, repeat, or replicate
Fluidity of subject matter (capability to change course)
Dependence on technology/malfunction recovery or workaround
Number of students to be trained
Availability of subject-matter experts
Ability to use training material often
Availability of facilities

Effectiveness

The level of activity required to perform a task can affect the training method required. For instance, learning how to assemble the hardware components of a computer system requires participation in a number of activities. The

student could watch someone else do it numerous times and still experience difficulties when trying to do it. Hands-on performance would be needed to provide the interactivity and learning. Keyboard activities are similarly inappropriate for classroom-style passive learning. In contrast, understanding a concept, such as the managerial uses of data, can be performed with a minimal level of activity on the students' part even though the training may be highly interactive.

The extent to which proficiency in a task or the level of detail of the knowledge is required can affect the appropriateness of a training method. Seeing a function performed to learn how long it takes or to become aware that it exists is different from having to perform the action quickly and accurately oneself.

The audience itself can affect the training method. An experienced group of operators may not need detailed instructions on how to produce a new report that differs only in the specific details from existing reports. Completely untrained personnel, on the other hand, will require far more time and attention to absorb the same level of information.

At the same time, the students may display a range of capacities within the same group. While one may prefer to plan another approach, it may be necessary to conduct training in this manner. In that case, the method selected must accommodate varying levels of preexisting knowledge and be able to proceed at different rates.

Aside from the degree of detail of knowledge required and the need for hands-on training, the material the students will use and the students themselves may require varying degrees of interaction with an instructor. That interaction is particularly needed in cases in which "helpful hints" are to be passed on to increase proficiency on a task, we expect some students to have more difficulty than others, or the ADS supporting documentation is not complete or well-organized.

In some cases, the instruction requires a multimedia presentation. Although exiting training material may provide some presentations, the training environments must be suitable for the use of audiovisual tools and live instruction or hands-on training when they appear to be indicated.

Most standard training methods require the participation of a proficient instructor who can pass on defined skills. An example is the preparation of routine reports. Because ADS operations tend to require interaction with computers in a language with which operators may not be fully proficient, unexpected events occur; an expert instructor on-site is needed to deal with such cases. Another example is the training of managerial personnel on concepts of new programs; the instructor must be intimately familiar with the program's requirements and its intent in order to anticipate and respond to questions from the audience most of whom will not accept an unsure or defensive response.

Finally, the complexity of the material affects the suitability of the training method. If a task that is otherwise suitable for mass classroom instruction is complex or tedious, visual aids or other tools are needed to keep the students' attention and to provide them with continuing orientation and cues to understand the concepts being discussed.

Cost

Even where training effectiveness requirements are established and met, the issue of cost remains.

Costs are incurred in several areas: course development, personnel, facilities, and equipment. Course development costs include the costs to develop a course objective and training scope, to prepare the draft course materials, to produce the course materials, to store the produced material, to disseminate the material, and to upgrade or modify training. For certain training media, such as videotapes or computer-based training (CBT), additional cost factors are incurred, such as text, video, and graphics or software authoring copyrights.

Personnel costs associated with the students and the instructor follow a common structure. They are generally associated with travel, billeting, meals, and the cost of the course itself. Instructor-related costs vary depending on such requirements as travel, per diem, and compensation for time spent preparing for the course and presenting it.

Costs associated with facilities and equipment can include use of a training site, utilities, training aids, and satellite signal transmission/recieving equipment.

Constraints

In addition to effectiveness and cost issues, some practical constraints must be considered. We show them in Table 3-1.

The length of the course can be a significant factor in assessing training approaches. For example, data-entry operators may require longer training packages, given the fundamentals associated with keyboard skills required for some ADS operations. At the same time, for generalist training or orientation briefings, a 1- or 2-hour briefing may be sufficient. Thus, course length is a factor in the selection of training alternatives. If a training session can be effectively conducted with 2 hours of course work, it would not be cost-effective to transport a number of students to a cental location for training; such training would be more cost-effective at the local level.

Aside from the length of the course, other timing issues arise. The nature of military activities includes some planning uncertainty, including "on-again, off-again" funding opportunities; thus, flexibility in the scheduling of the

development and presentation of certain instruction is important. Some training methods are inherently more flexible than others. Not only are the development and presentation dates subject to change, but because of the sheer number of personnel to be trained or different time constraints at different locations, training may have to be repeated within certain windows or may have to be repeated continuously (e.g., quarterly for an indefinite number of years). Finally, with regard to timing issues, the nature of the material and the way in which it is to be used may mean that students will need to refer back to their course mat al frequently after the training session is over; some methods lend themselves to self-repetition by the students and others do not.

Technology changes or software improvements are common in)S, and regulations change frequently in the environmental milieu. Training decisions are affected when students' information loses currency as a result of changes in the external world or when continuing cycles of students require training that can keep pace with the changes in the external world. Some training methods are easily changed or redone; others are very costly to change or very expensive to establish in the first place; those methods should not be used in a situation in which frequent change is expected.

The number of personnel requiring training needs to be addressed in selecting training methods. Most training options have limiting factors: space available for training, number of workstations available, limited number of training monitors for one-way video teleconferencing, etc.

TRAINING METHODS

We reviewed various training methods to assess their effectiveness for ADS training. Those methods are listed in Table 3-2.

Personal Instruction

At present, in the absence of other training methods, the Army provides formal off-site training. While it prefers to conduct such training in conjunction with currently required courses (annual refresher courses, courses required for promotion, etc.), the Army may not yet have included the required material in such courses, or the timing of the course may be unacceptable. Also, in many cases, a course or an application process may have a waiting list, which creates a degree of uncertainty. In such cases, custom courses may be provided through Army schools, by Army staff experts, or by contractors. In any event, formal off-site training is conducted in standard classes although other training methods such as hands-on computer training, audiovisual tools, etc., may be incorporated. We assume that, because it is their mission, these training classes are effective in teaching the required information to the degree possible in a classroom.

Table 3-2.
Training Modes Suitable for ADS

Personal instruction
Formal off-site training (stand alone)
Formal off-site training (modular)
Formal on-site training (decentralized vendor)
Teleconference (audio, video, computer)
Train-the-trainer
1-800 number hotline
Vendor briefing
On-the-job training (OJT)
Self-instruction
Videotape
Computer tutorial (embedded training)
Programmed text
Correspondence course
Staff briefing
ADS documentation package[a]

[a] Includes system documentation, user's manuals, operator manuals, brochures, etc.

Formal on-site training shares most of the characteristics of its off-site counterpart except it does not require installation staff members to travel. Because the Army provides a number of the facilities, the cost per student is lower, and the timing is more readily controlled by the installation. However, if students are dispersed throughout the Army, many may have to travel to such training anyway; for those students, formal on-site training is not greatly different from formal off-site training. Additionally, the course may have to be offered many times at many locations, and that may become a logistical challenge. On-site training can be provided by contractors as well as by Army staff members or Army trainers.

Teleconferencing is a training technique that can be performed by video, audio, or computer. Audio conferencing is relatively inexpensive but is limited by the lack of visual presentations, thus reducing interactivity. For training applications, one-way video with two-way audio links is perhaps the best alternative in terms of cost and quality of information transmitted (effectiveness). The Army has the ability to provide two-way audio and two-way video conferencing as a result of TRADOC's consolidation of the Satellite Education Network and the Teletraining Network. That form of video teletraining is especially attractive to the Reserve Component and the National Guard, given that training can be brought to them when they need it, e.g., on drill weekends. Teletraining systems of this type require the use of satellite links for signal transmission. Costs can be reduced by sharing satellite segments, and technology upgrades are best utilized by procuring equipment through a lease-purchase contract. Computer conferencing is relatively inexpensive if the hardware (workstations) is available, and

this method of teleconferencing can be set up to avoid the scheduling problems of audio and video conferencing. With computer conferencing, trainees can interact with a trainer and with each other at different times and from different locations over telephone networks.

Train-the-trainer is a training method in which a cadre of individuals is given formal training and then return to their permanent duty locations to train other individuals there, usually in an informal way. That method may involve a wide range of training tools, just as formal off-site training does; the point of such training is that it limits the number of people that require formal (funded) training.

The 1-800 number hotline is an extended training method whereby people with questions and concerns can call an expert to ask specific questions. Clearly, it cannot substitute for intensive training when that is required; but it has value for minor updates or for posttraining refresher information or advice.

Vendor briefings are available either from ADS developers or from professional trainers. Those trainers may also be Army specialists or subject matter experts. Such briefings tend to be effective in presenting the details of required material and answering technical questions; professional trainers are most effective in presenting the defined material, but they may not be able to answer unanticipated questions or to discuss Army-specific issues fundamental to ADS data management systems.

On-the-job training involves a qualified supervisor's training of an individual during the course of performing the required task. Where properly implemented it is a "learn by doing" approach. On-the-job training does not include simply giving people jobs without preparation and letting them learn by experience. Quite often it can be used for orientation training for new personnel, and it is the logical extension of the train-the-trainer method.

Self-Instruction

Training can be developed at a central location, recorded on videotape, and reproduced in as many copies as wanted. The videotape creates the illusion of having a live, personal instructor without incurring the expense of doing so. Users can then watch it whenever they want, with the only requirement being the availability of a tape player. The tape may be accompanied by written material for clarification.

Army or contractor organizations can prepare professional-quality training or "briefing" style presentations on videotape. However, the cost for using a contractor to do so is high and substantial development time is needed, especially when subject matter experts, scriptwriters, production crews, and editing are required. The final product is typically available 6 months after scriptwriting. TRADOC has compiled a bidders list of production crews located in the geographical area in which filming is required. Using contractors from that list

is one way to keep the bid price low. A videotape is also less expensive if done in-house. Educational television programs are available at Aberdeen Proving Ground and in TRADOC.

Less "personal" in appearance but much more interactive are the tutorials that are included directly in the distributed software. The Army uses the term "embedded training" for such tutorials. The training is integrated with the work so that a person moves freely from work to training and then back to work. Private-sector software companies have been using such training as a matter of course for years. System users can then train themselves, with computer assistance, to perform most of the routine tasks; the depth and complexity of the tutorial is a matter of the funding the project manager wishes to include.

Tutorials are simply automated versions of the programmed text, a concept that the Army has used for years. In that training method, a standard course book includes frequent in-progress quizzes. Based on the quiz answer selected, the student is guided back to the page on which appropriate material can be found in a refreshment cycle or is allowed to continue forward in the text. The pages of the text are generally organized randomly to prevent students from bypassing the quiz and just reading the material directly.

Correspondence courses are less interactive versions of the programmed text. A textbook is provided for reading; it often contains quizzes along with the answers so that the student can ensure that the material is understood satisfactorily. At the end of the book, a quiz without answers is provided; the student mails an answer sheet to a cental training facility and the quiz is graded. Ideally, question-by-question results (rather than a single score) are returned to the student who can then review the questions that were missed; in practice, this seldom happens.

Correspondence courses can be developed through TRADOC. That development entails creation of the course and printing, distributing, and recording the student's progress. Those actions can be combined with computer-based instruction or videotapes if one has access to a VCR or personal computer. Costs for development of correspondence courses increase when outside contractor help is required. Courses are fairly easy to update; one simply needs to insert a camera-ready page in the text.

Staff briefings, by contrast, are conducted by the system proponents or the users of the system at higher levels. For example, a MACOM representative may brief an installation commander on the use of an ADS or an Army proponent agency staff member may brief potential users or operators. Sometimes these briefings are given through a teleconference or on videotape; the point is that the trainer is neither a system nor a training expert but rather, a person who knows why the system is being used and should understand the user's perspective.

Finally, the basic task material itself with no training components attached consists of regulations, books, etc. In the ADS environment, this material is the suite of documentation that should accompany the ADS. It should include as a

minimum the data dictionary and the operator's guide. The data dictionary provides the data structure and the definitions of the data elements (both format and content), while the operator's guide explains how to use the system in terms of what the keystrokes do. In addition, a user's guide (distinct from the operator's guide) is often provided and it offers more of a system overview: who uses the system, how the data flow, and what the project manager intends the system to do.

Well-written documentation should include a tutorial with the operator's guide. In some cases, that tutorial simply instructs on the mechanics of performing the major system operations, and in others a mini-case is provided to illustrate the process and purposes of system operations. While these are the basic documents, they can have strong training value, especially for systems that are modifications to other well-established, familiar systems.

Summary

We conducted a study of the applicability, costs, and other factors associated with each of the methods proposed for ADS training. In that study, we reviewed literature (trade journals) and interviewed Army training specialists at TRADOC installations, other Army agencies, and private-sector training companies. The results of this assessment are presented in Table 3-3, in which principal advantages and disadvantages of each method (in terms of the utility factors noted earlier) are compared across methods.

MATCHING TRAINING METHODS TO ADS REQUIREMENTS

In Table 3-4, we apply the three utility factors (effectiveness, cost, and constraints) to each type of ADS personnel. We do not show training for the data system administrator (who is assumed to be a trained ADS professional and may in fact be responsible for much of the training) or for the project manager, who is assumed to be a functionally competent general manager responsible for the effective functioning of the overall ADS, including both physical and human components.

Table 3-5 combines those perspectives to indicate the relative value of these training methods with respect to the specific needs of personnel in the organizational roles discussed in Chapter 2. Costs associated with specific training methods are referenced in the appendix.

Data-Entry Operator

Data-entry personnel must perform the following activities:

♦ Operate the physical components of the ADS

♦ Input data submitted by the functional specialists

♦ Develop queries as necessary

♦ Generate outputs (reports, summary tables, etc.)

♦ Transfer data between data bases

♦ Provide recommendations for system improvement at the user's level

♦ Load software updates as specified by information systems program personnel.

Training for data-entry operators must focus heavily on hands-on applications; training methods that limit hands-on applications are of no benefit. At this level, system operational procedures must be fully understood and followed; individual interpretation has no place in this training. Paradoxically, this training requires the maximum amount of interactivity to avoid initial misconceptions about data system capabilities. Additionally, the detail of instruction presented typically results in numerous queries that require accurate, timely responses.

The best methods for training data-entry personnel are formalized courses/resident courses, computer-based training (CBT), decentralized vendor training, on-the-job training, and train-the-trainer. These methods provide the greatest amount of user hands-on application and the best opportunity for interaction.

Students — primarily those entry-level operators who require the interaction and hands-on training available with resident training — can be trained off site. The class mix, however, should be homogeneous, i.e., all students in the class should have the same level of experience so that training can proceed at a uniform pace. Given the daily work regimen, absence of data-entry operators from their work location during the training period may not affect daily operations. Such may not be the case when a data-entry operator is performing other tasks within the organization, especially when staffing is short. Sending data-entry operators to resident training enables them to focus on the details of the course without daily work distractions. The costs of conducting formal training for large numbers of personnel are significantly higher than those for other methods, but for this level of personnel, effective alternatives may be limited. This choice is certainly dependent on the objectives of the course and the skills of the prospective students.

Table 3-3.
Comparison of Training Modes to Utility Factors

Utility factors	Formal off-site training (stand alone)	Formal off-site training (modular)	Formal on-site training (decentralized vendor)	Teleconference (audio, video, computer)	Train-the-trainer
Effectiveness					
Active task versus reading or knowledge skill	O	O	O	–	+
High degree of knowledge required at end of training	+	+	+	–	+
High degree of audience knowledge or experience	O	O	O	+	O
Wide range of audience experience	–	–	–	O	+
Need for interactive instruction	+	+	+	+	+
Need for multimedia	+	+	+	+	–
Need for expert instructor versus exposure to material	+	+	+	O	O
Complexity material	+	+	+	–	–
Cost					
Development	–	–	–	+	–
Operational	–	O	O	–	–
Opportunity (personnel time)	–	+	O	+	+
Constraints					
Length of course	+	–	–	–	–
Flexibility of timing	–	–	+	+	+
Ability to reschedule, repeat, or replicate	–	–	O	O	+
Fluidity of subject matter (capability to change course)	O	O	–	O	
Dependence on technology/malfunction recovery or workaround	+	+	+	–	–
Many students to be trained	–	–	+	–	+
Few subject-matter experts available	+	+	O	O	–
Requirement to use training material often	–	–	–	–	+
Availability of facilities	O	+	O	–	+

Note: + = Method favored when this utility factor is important – = Method may be inappropriate when this utility factor is important and O = No impact

Formal off-site training (stand alone)	Formal off-site training (modular)	Formal on-site training (decentralized vendor)	Teleconference (audio, video, computer)	Train-the-trainer	1-800 number hotline	Vendor briefing	On-the-job training	Videotape	Computer tutorial (embedded training)	Programmed text	Corre de co
O	O	O	−	+	−	−	+	−	+	−	
+	+	+	−	+	−	−	+	O	+	O	
O	O	O	+	O	+	O	+	O	+	−	
−	−	−	O	+	+	−	+	−	+	+	
+	+	+	+	+	−	−	+	−	O	−	
+	+	+	+	−	−	O	−	O	−	−	
+	+	+	O	O	−	+	+	O	−	−	
+	+	+	−	−	−	−	+	−	O	−	
−	−	−	+	−	+	O	−	−	−	−	
−	O	O	−	−	+	O	+	+	+	+	
−	+	O	+	+	+	+	+	+	+	+	
+	−	−	−	−	−	−	−	−	−	−	
−	−	+	+	+	+	O	+	+	=	+	
−	−	O	O	+	+	O	+	+	=	+	
O	O	−	O	−	+	+	−	O	−	−	
+	+	+	−	−	+	−	−	−	O	+	
−	−	+	−	+	+	O	+	+	+	+	
+	+	O	O	−	+	+	−	+	+	O	
−	−	−	−	+	+	−	−	+	+	+	
O	+	O	−	+	−	+	+	+	+	+	

Method may be inappropriate when this utility factor is important and O = No impact/not relevant/has both advantages and drawbacks

Train-the-trainer	1-800 number hotline	Vendor briefing	On-the-job training	Videotape	Computer tutorial (embedded training)	Programmed text	Correspon-dence course	Staff briefing	ADS documentation package
+	−	−	+	−	+	−	−	−	−
+	−	−	+	O	+	O	−	−	+
O	+	O	+	O	+	−	−	O	O
+	+	−	+	−	+	+	−	+	−
+	−	−	+	−	O	~	−	−	−
−	−	O	−	O	−	~	−	O	−
O	+	+	O	+	−	−	−	−	−
−	−	+	−	−	O	~	−	−	−
−	+	O	−	−	−	~	−	+	+
−	+	O	+	+	+	+	−	−	+
+	+	+	+	+	+	+	+	+	+
−	−	−	−	−	−	−	−	−	+
+	+	O	+	+	=	+	+	+	+
+	+	O	+	+	=	+	+	+	+
−	+	+	−	O	−	−	−	+	−
−	+	−	−	−	O	+	+	+	O
+	+	O	+	+	+	+	+	O	+
−	+	+	−	+	+	O	O	−	−
+	+	−	−	+	+	+	+	−	+
+	−	+	+	+	+	+	+	+	+

No impact/not relevant/has both advantages and drawbacks

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Table 3-4.
Factors Relevant to People Involved in ADS

Utility factors	Data-entry operator	Functional specialist	Functional manager
Effectiveness			
Active task versus reading or knowledge skill	√	X	X
High degree of knowledge required at end of training	√	X	X
High degree of audience knowledge or experience	X	√	
Wide range of audience experience	√	X	
Need for interactive instruction	√	X	λ
Need for multimedia	N/A	N/A	N/A
Need for expert instructor versus exposure to material	√	X	X
Complexity of material	√	X	√
Cost			
Development	N/A	N/A	N/A
Operational	√	N/A	N/A
Opportunity (personnel time)	X	√	√
Constraints			
Length of course	√	X	X
Flexibility of timing	X	X	√
Ability to reschedule, repeat, or replicate	√	√	√
Fluidity of subject matter (capability to change course)	X	√	X
Dependence on technology/malfunction recovery or workaround	√	X	X
Many students to be trained	√	X	X
Few subject-matter experts available	X	√	√
Requirement to use training material often	√	X	X
Availability of facilities	–	–	–

Note: √ = relevant to job position. – = not relevant to job position. N/A = not a consideration

For students with more systems experience in general but without the specific application or for those who are receiving refresher or upgrade training, less formal training is needed. In those cases, software tutorials (embedded training), videotape, or briefings offer the necessary training augmentation.

On-the-job training is an effective method for rapidly providing training for a large and dispersed audience. It should be structured, and it is dependent on the availability of local experts or training reference material. It is a natural

adjunct to the train-the-trainer method and requires the interaction between installation personnel who have been trained in the application and use of a software package and in-house operators who require such training. OJT is often necessary when a number of personnel require training in the use of the same ADS. Army installations have taken advantage of that type of training for hazardous waste tracking systems.

Training methods other than those described here should be avoided when dealing with initial training for data-entry operators because they tend to limit user hands-on time and the interaction necessary for effective training. Videotape courses, for example, have some value in refresher training but are typically ineffective in conducting initial training because they lack instructor interaction. They also have difficulty in portraying a computer screen more effectively than the computer itself does and in combining video instruction with a hands-on keyboard session.

Functional Specialist

The functional specialist must be an expert in a given subject area, such as hazardous waste, air quality, or the like and be able to do the following activities:

* Provide the needed input data in the correct form

* Extract information from the ADS (either directly or through data-entry operators)

* Perform quality control on data submitted to data-entry operators and on data manipulation within an ADS.

Instruction programs designed for functional specialists should concentrate on the interface between reality and the system's data interpretation of that reality. The details of those programs will vary with the specific function, but the essential concepts to be passed on are the need for data and the way in which the system records those data (i.e., the format in which data must be prepared for entry into the system).

Additional training should emphasize the outputs that the ADS can generate to assist the specialists in performing their jobs and how they can use outputs to review the data and assess the quality of the data in the system. Functional specialists do not necessarily require detailed, hands-on, keyboard-oriented knowledge of the ADS unless they require specialized reports on a regular basis.

Table 3-5.
Training Methods for ADS Personnel Roles

ADS personnel roles	Formal off-site training (stand alone/ modular)	Formal on-site training (decentralized vendor)	Telecon-ference (audio, video, computer)	Train-the-trainer	1-800 number hotline	Vendor/staff briefing	Or t
Data-entry operator	Inexperienced operators, specialized or complex training	Locations with many operators		ADS manager at locations with multiple operators	After-delivery support	System upgraded briefings	Loca multi opera wher the-t be u supe
Functional specialist			Report capability			Simple media program	Data
Functional manager			System overview			System updates	
Project manager	Data management concepts						

-site g ized)	Telecon-ference (audio, video, computer)	Train-the-trainer	1-800 number hotline	Vendor/staff briefing	On-the-job training	Videotape	Computer tutorial (embedded training)	Programmed text	Correspon-dence course	ADS documentation package
with		ADS manager at locations with multiple operators	After-delivery support	System upgraded briefings	Locations with multiple operators where train-the-trainer will be used for supervisors	System upgraded briefings	Operators with general computer experience			Data dictionary to support queries, operator's guide
	Report capability			Simple media program	Data review	Report capability, system upgraded briefings	Report capability	New or complex media program		User's manual
	System overview			System updates		System overview				User's manual
										Complete system documentation

Vendor/staff briefing	On-the-job training	Videotape	Computer tutorial (embedded training)	Programmed text	Correspondence course	ADS documentation package
System upgraded briefings	Locations with multiple operators where train-the-trainer will be used for supervisors	System upgraded briefings	Operators with general computer experience			Data dictionary to support queries, operator's guide
Simple media program	Data review	Report capability, system upgraded briefings	Report capability	New or complex media program		User's manual
System updates		System overview				User's manual
						Complete system documentation

The functional specialists at each level — especially those at the local level — perform the majority of the compliance work. Local and intermediate staffs tend to have but one specialist in each functional area. Therefore, an organization cannot be expected to release functional specialists for training over an extended period. Group interaction, if any, emanates from communication with similar specialists at other installations or MACOMs.

Training for such specialists must be topical and succinct. It needs to address the ADS as a tool and does not need to provide expert operating skills. The training methods include teleconferencing, videotape, train-the-trainer, briefings, or computer conferencing. Programmed text can also be effective. These training methods can also be presented in a timely fashion and can address topics specific to the functional specialists' needs.

Computer software tutorials and formal courses should be avoided. For the cost to be justified, they must provide in-depth knowledge for the ADS, which is not necessary for the functional specialist.

Functional Manager

Functional managers have three major duties:

♦ Manage mission activities

♦ Use ADS outputs to assist in areas such as resource allocation

♦ Ensure that the ADS is being properly maintained and upgraded to meet the needs of the installations.

Functional managers do not need to know the details of ADS procedures as do data-entry operators. They do need to know generally what data elements reside in the system; how a program can be a tool in determining compliance status, resource allocation, etc.; and what kind of specialized reports or queries the ADS is capable of generating. The paramount requirement for their effective management of the system from a programmatic view is an understanding of the purpose of the ADS and the utility of its products at their command level. In addition, they need to see the ADS in a larger context: how it can help them in decision-making and developing management strategies, both directly and in combination with other data sources. And they need practical ADS management skills: how to check the data to ensure they are being maintained without having to perform an exhaustive audit; how to manage the ADS within their organizations; how much effort is needed to support it; and when and how people should be trained.

Effective training methods for functional managers must offer a general overview of the capabilities of the ADS as a management tool. They must emphasize functionality and brevity since the managers cannot be asked to drop all their other responsibilities to attend formal courses. Training methods

applicable to functional managers include teleconferencing, videotapes, and decentralized vendor training. The method selected should be based on the specificity or depth of the subject matter presented: a major new item of software may be introduced by a teleconference, while a brief information review of a software update may be well-suited to a videotape presentation.

Methods that are inappropriate at this level include formal resident training, programmed text, or correspondence courses. They are too time consuming or detailed for the degree of personal use of the ADS expected of functional managers, given the limited time they can be away from their work locations.

Specific Comments for Levels of Organizations

The preceding roles and training methods do not vary significantly at different organizational levels. At higher levels, the roles of functional specialist and functional manager tend to converse to some degree. Thus, training may require instruction in a combination of skills, and thus different phases may have to be conducted using different methods for the same person. However, to the extent that an individual performs a role (data entry, functional review, or program management), the comments still apply to the training needed for that role.

The content of the training may need to be revised. For example, at the local level, operators perform manual input and work with only one file; at higher levels, they often merge files submitted by local offices and only seldom perform manual input. Again, therefore, the content and delivery of the material must be tailored to the needs of the specific audience.

Overall Training Strategies for ADS

In this chapter, we reviewed the roles and training requirements of the personnel who must work with an ADS. We have also considered the types of training methods available and (in conjunction with the detailed data in the appendix) the strengths and weaknesses of those methods when applied to ADS. Table 3-5 portrays the ways in which training methods may be appropriate for ADS training. That portrayal outlines the methods that a manager should consider when planning to conduct ADS training; managers should be extremely cautious before adopting a training method not recommended in Table 3-5.

In the next chapter, we consider these methods as they may apply specifically to ACTS.

CHAPTER 4

Training for the Army Compliance Tracking System

The ACTS is an ADS designed to achieve two principal goals: first, to maintain and track the compliance data required by the installation staff to perform their mission and second, to provide a means of collecting and reporting data required by the Defense Environmental Management Information System.

As with most other ADS applications, data are collected by functional specialists at the local level and entered into ACTS by data-entry operators. The information is passed on in electronic form to higher headquarters where it is aggregated with other installation submittals. Those aggregate reports along with installation data are passed to, and stored by, the Army Environmental Center (AEC). The data are used to respond to Department of the Army data requirements.

In the ACTS context, the local level is the installation environmental staff; the intermediate level is the major subordinate command (MSC) or the MACOM environmental staff; and the executive level is the Army's Office of the Director of Environmental Protection, chiefly represented for technical and program issues by AEC. AEC provides the system administrator from its Resource Management Division and the project manager from the Environmental Compliance Division. At every level within the Army, users must be able to input or import data, query the system, and generate paper and electronic outputs.

In the remainder of this chapter, we examine the appropriateness of the various training modes with respect to those personnel who either perform a direct role in generating ACTS data or have a need to know what information can be derived from ACTS. Table 4-1 summarizes the roles and training modes.

DATA INPUT AND IMPORTATION

The data input function is generally performed by data-entry operators. At some installations, based on staff availability and on individual expertise, functional specialists may enter the data into ACTS. At intermediate headquarters and AEC, installation-level data entry is performed through an importation of function capability in ACTS. Some direct input is performed at intermediate levels as staff members review the installation data and correct erroneous or garbled data.

Within the data entry context, the most important feature of ACTS is that its keyboard functions are similar to those of the DB1383 system, which has been in place at Army installations for a number of years as the primary mechanism for planning and executing the Army Environmental Program. As a result, many operators are familiar with the DB1383 data base and should be able to perform the hands-on skills required to operate ACTS. Therefore, planning for hands-on training for ACTS users should take into account the depth of the audience's familiarity with the DB1383 system in order to avoid offering training on knowledge, skills, or abilities that already exist.

Users who have experience with DB1383 and those who are experienced with personal computers (PCs) can receive their training with computer software tutorials or can use the programmed text method. More-interactive training methods should be followed for operators with limited computer experience and no DB1383 experience. Operators familiar with the DB1383 data base should be able to complete an ACTS tutorial in 2 to 3 hours; new users may need up to 3 days of classroom training. We assume that operators need little familiarity with the environmental programs and their data requirements because that information will be provided by the functional specialists. That assumption may not always be correct; where it is not, operators may have to be trained as functional specialists; this should not be a goal of ADS training but rather should be undertaken by the installations that have such a problem.

As a rule, functional specialists contribute to the data-entry process by providing the data in the format required by ACTS. To do so, they must be familiar with the type and format of data required by ACTS but do not necessarily have to be trained in data entry. Additionally, to perform the data quality control task, specialists need training on the nature of the reports or data extraction processes available through ACTS in their area of expertise. They may also need text associated with ACTS to provide examples of where some of the required data elements may be obtained. Finally, they need to understand the total set of relevant information contained in ACTS, both for the quality control process and to obtain information about their functional area for management purposes. Such training for a functional specialist should not require more than 1 hour of live presentation or 2 hours of studying text material. Functional specialists who may have a cursory knowledge of the media program of interest will require additional ACTS training as well as training in their media area of expertise. Where functional specialists will have to enter data, they must receive training similar to that of a data-entry operator.

4-2

Table 4-1.
Training Methods for the ACTS

ADS personnel roles	Formal off-site training (stand alone/ modular)	Formal on-site training (decentralized vendor)	Teleconference (audio, video, computer)	Train-the-trainer	1-800 number hotline	Vendor/staff briefing	
Data-entry operator	Inexperienced operators, SQL training		Updates to existing system		After-delivery support		
Functional specialist			Report capability			Simple media program	D
Functional manager			System overview			System updates	
Project manager	Data management concepts						

Note: DB1383 is a data system fielded by the Army for tracking environmental compliance products Many of the functional procedures for ACTS are

	Telecon-ference (audio, video, computer)	Train-the-trainer	1-800 number hotline	Vendor/staff briefing	On-the-job training	Videotape	Computer tutorial (embedded training)	Programmed text	Correspon-dence course	ADS documentation package
Updates to existing system			After-delivery support				DB1383 or general computer experience	DB1383 experienced operators		Data dictionary to support queries, operator's guide
Report capability				Simple media program	Data review	Report capability	Data input	New or complex media program		User's manual
System overview				System updates		System overview				User s manual
										Complete system documentation

ntal compliance products Many of the functional procedures for ACTS are based on those already established in DB1383 SQL = structured query language

Vendor/staff briefing	On-the-job training	Videotape	Computer tutorial (embedded training)	Programmed text	Correspon-dence course	ADS documentation package
			DB1383 or general computer experience	DB1383 experienced operators		Data dictionary to support queries, operator's guide
Simple media program	Data review	Report capability	Data input	New or complex media program		User's manual
System updates		System overview				User's manual
						Complete system documentation

es for ACTS are based on those already established in DB1383   SQL = structured query language

Functional managers should typically receive little data-entry training. Within the ACTS context, however, at many installations, functional managers have been the primary operators of the DB1383 system; thus, they may be more familiar than most people with the capabilities of ACTS. Detailed data-entry training is inappropriate for these managers, but they must have some degree of orientation so that they have an idea of the level of effort required to support the system. Most important, the manager needs to have a good overview of the type of data in ACTS to understand the complete range of the data system (and its effect on the specialists working on the different compliance programs) and to know what type of information is available to support management decisions and the nature of reports sent to higher headquarters.

In summary, functional managers can receive overview training on ACTS through a teleconference or by videotape. Installation commanders, who may ultimately be responsible for timely submission and the accuracy of ACTS-generated reports, can receive the same overview training. Because the training needs of functional specialists are more narrowly focused and thus presentation of the training material does not require a great deal of time the Army should focus on such methods as user guides and other programmed text augmented by CBT or videotape in developing an effective training module. Experienced data-entry operators should be trained with software tutorials, and new data-entry operators should receive their training in formal classes.

DATA IMPORTATION AND EXPORTATION

The ACTS has three import/export capabilities: it can transfer its main data files, import modules such as the Environmental Compliance Assessment System files, and export records to dBase™ files. A data-entry operator can quickly acquire the required skills using programmed text (user guide) or a software-based tutorial using the record/file transfer procedures.[1]

The dBase exportation capability was designed into the system in response to demands from users who were familiar with the dBase format and had no knowledge of structured query language (SQL) (ACTS' query language). Therefore, those wishing to use this feature should need no training on the dBase program. Users who require training should be trained on SQL. Such training will require off-site formal classes, probably from a university or SQL software vendor and may take 10 - 20 days continuously or one to two semesters of periodic

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[1] In 1993, the ACTS import/export capability was used to create a new process: the return of amended files from higher headquarters to the installations. The data management implications of overlapping information that comes from different times and different perspectives, along with the possibility of downloading old information to replace newer and better data suggest that ACTS data system administrators, project managers, and functional managers at higher headquarters levels receive formal training before engaging in this practice.

attendance to gain an effective working familiarity. It will also require frequent on-the-job reinforcement.

QUERIES AND REPORT GENERATION

The ACTS was designed to generate reports rather than to serve as a data base. It has evolved toward a data base system, but that process is incomplete. Its primary capability, therefore, is still to provide reports and track compliance rather than customize data. ACTS data can be accessed by screen review, report generation, "point-and-shoot" report generation, and direct querying through SQL.

Screen review is simply the process of scrolling through the data-entry screens. This is an intuitive form of "query" and requires no special training. At the installation level, it may be the most effective form of data review for functional specialists if only a few data screens are relevant to the subject of interest.

A number of preprogrammed report modules that in earlier iterations were the only available means of reort generation are available from ACTS. The reports can be produced easily by using the screen menus and user's guide, which represents a very cost-effective form of training for this capability.

The ACTS "point and shoot" option may be used to generate custom-designed reports. With that option, personnel who are not familiar with SQL can create reports. Training in this feature can be provided by the user's guide and a certain amount of hands-on experimentation. As a rule, the output is a full data-base report; as of March 1993, the point-and-shoot feature did not include elaborate parameter-setting options. Therefore, because the operators must define the output columns and select the data elements of interest, they need much more training, and a software tutorial would be very useful in providing it. If formal courses are being offered as part of the data-entry operator training, the use of the point-and-shoot option to generate custom reports should be a module of such training. Functional specialists and managers should be provided with an orientation to the point-and-shoot module's capabilities and to its many limitations (from the point of view of those familiar with the query capabilities of a full data-base management system). Such orientations can be provided by the videotape, teleconference, or programmed text methods.

The use of SQL to build and execute queries allows for a more complete use of the system from the perspective of specialized report generation. SQL, while an "industry standard," is a standard in the same sense that the Microsoft disk-operating system is a standard that underlies most PC applications; most users and programmers use a higher-order language in their daily work. For example, the popular dBase™ family of data base programs are SQL-generated. Users do not ordinarily access the underlying SQL code. Direct access to SQL is generally appropriate for the system developers. To use SQL effectively, formal training

will be required. However, keyboard operators can develop a limited capability to operate in SQL by using CBT (tutorials), taking correspondence courses, or following programmed text. Additionally, complete system data documentation is needed to use SQL effectively.

In summary, operators can receive ACTS training on queries and report generation in a number of ways depending on the operator's capabilities and on the degree of expertise required to meet managers' needs for data. The selected method may include formal-resident or on-site training, tutorials, user's guides, or correspondence courses. Functional specialists and managers requiring an introduction to ACTS reporting can be exposed to SQL by tutorials or programmed text. SQL training should be conducted through formal course work.

DATA ANALYSIS

At present, ACTS has an extremely limited capability to support functional specialists and managers in data analysis: it can generate reports. Because of that limitation, training for functional specialists and managers needs to focus on the ways that the data in ACTS can be used as a tool for resource allocation and management strategies. Any of the training methods can be used for a discussion of how ACTS data can be reviewed and used at the installation level.

At higher levels, particularly at AEC, where SQL programming support is readily available, analysis is more readily performed. At those levels, the analyses themselves form the training material, as the project manager and system administrator develop management indicators from the ACTS data set and provide this information to managers at the Army Staff level and to the MACOM staffs. Once managers view such output, they may request similar capabilities for their use, and the necessary SQL routines can be developed and distributed. Training in this form of information transfer can best be done by staff briefings through teleconferencing and should form part of a larger staff briefing rather than being dedicated to ACTS issues.

In summary, data analysis orientation should be provided to managers at all levels through briefings, teleconferences, or programmed texts.

PROPOSED ACTS TRAINING STRATEGIES

Training of ADS users is dependent on the goals and objectives of training and the expertise of prospective trainees. Emphasis on the role that individuals perform also provides a means of selecting a suitable training technique with ACTS as an example. Resident training or the use of programmed text, computer-based training, or videotapes can constitute the initial training or orientation. Installation commanders must be considered when deciding on training strategies for the use of new systems for compliance. Without at least a basic orientation on the purpose for such systems, an installation commander cannot

be an effective proponent nor be made aware of the role to serve in environmental compliance issues.

We recommend that the Army Environmental Center take the following actions:

- *Identify the level of experience of current and installation-proposed ACTS operators and the turnover in primary ACTS operators.* Based on that information, AEC can determine the frequency and detail of ACTS training required.

- *Require ACTS software developers to produce tutorials to accompany new versions of software.* One tutorial module should be directed toward new users, and one module should note the new features of the software updating.

- *Issue a loose-leaf binder containing samples of the current programmed report formats, require the system developer to provide a "crosswalk" of the data elements to those reports, and update the binder every 6 months by issuing new report formats and a revised crosswalk matrix as pages change.* This process will require a minimal effort once the developers determine how to produce the crosswalk; the expense of issuing the changed pages will be significant. However, that much of that expense is already incurred because new report formats are already being distributed on diskette. Over time, the ACTS developers should provide on-screen report samples. Paper documents would still be needed by nonoperator personnel (specialists and managers).

- *Under guidance from the Office of the Director of Environmental Programs (ODEP), develop briefings for managers on the ways in which ACTS information can be used for management purposes.* These briefings should include extensive graphics support based on SQL-generated outputs from ACTS. Once complete, the briefing should be videotaped and issued to all installation and intermediate staff managers. As specific uses become popular, AEC should task the ACTS developer to incorporate specific queries and displays into ACTS.

- *Require the ACTS developers to issue ACTS documentation along with its software releases.* Either as part of that documentation, or as separate publications, modular briefings or instructions need to be prepared to give functional specialists the necessary information to support ACTS data requirements and to use ACTS data themselves. Until such documentation is available, AEC should sponsor media-specific teleconferences to be attended by functional specialists to review data-entry functions and other requirements and capabilities of ACTS.

Appendix

Cost and Other Factors Associated with Training Methods

RESIDENT TRAINING

This type of training is typically given in a classroom setting with formal course curriculum, instructor lead, training aids, and workstations r mally utilized to augment lecture subjects. The course is usually conducted during working hours and away from the facility/installation to which the student is normally assigned.

◆ *Cost elements (see Table A-1)*

▶ Course development.

▶ Preparation and production of course materials; handouts, transparencies, and manuals.

▶ Presentation of course (*instructor cost*).

▶ Instructor travel costs: airfare, lodging, car rental, and per diem.

▶ Student costs: airfare, lodging, car rental, and per diem.

▶ Cost for student to take course (fee, if any, plus salary while attending course).

Table A-1.
Cost Associated with Resident Training

Cost elements	Costs
Course development	Cost varies with size, location, and length of course. Instructor costs $900 – $1,200/week
Materials, Presentation	Preparation and production of course materials. cost equivalent to 25 percent of instructor classroom time.
Student and instructor travel	Travel airfare ($500), lodging ($50/day), rental car ($40/day), per diem ($36 – $42/day)
Student time	Student time $600 – $800/week

- ► Classroom: heating and cooling, electrical lighting, and power (indirect overhead cost incurred for courses held off military installations).

- ► Equipment: personal computer (PC) workstations; rental or purchase.

◆ *Number of personnel trained*

- ► Enrollment limited by available classroom space, billeting, course objective, and equipment.

- ► Optimum class will consist of students with same skill levels.

- ► Optimum student-to-instructor ratio: between 20:1 and 30:1.

◆ *Equipment requirements*

- ► Two students per workstation.

- ► Classroom equipment: public address (PA) system, desks and chairs, PC workstations, power connections to run PCs, and audiovisual aids.

◆ *Potential advantages*

- ► Students are presented with a multimedia approach to training (visual, written, and audio).

- ► Provides "hands-on" application of training.

- ► Highly interactive; instructor present to handle questions or problems as they arise and give individual attention where needed.

- ► Adaptable to a range of subjects.

- ► Students who complete course can function as informal instructors at the installation level.

- ► Provides for social interaction between students.

- ► Instructor-led courses can be developed in a short time frame at lower cost.

- ► Retention of course material typically high.

- ► Monitoring and enhancing instructor-led courses relatively easy and inexpensive.

◆ *Potential disadvantages*

► Inflexible in course location because of classroom and equipment re-quirements; location may not be convenient for some students.

► Group setting can be a problem when students have dissimilar needs or background skills; size of class limited by skills and available equipment.

► High cost as a result of travel, per diem.

► Quality and effectiveness may vary from one class to the next depending on student mix and multiple instructors.

► Courses cannot be provided immediately to fill in skill gaps.

► Trainee interest and involvement depend on instructor's skill.

► Pace set by instructor may be too fast for some, too slow for others in class.

► Students required to spend time away from work resulting in backload and loss of normally available critical skills while off-site.

TELECONFERENCING (VIDEO, AUDIO, AND COMPUTER CONFERENCING)

This type of training can be provided by installations having the equipment necessary to transmit and/or receive coursework by audio, video, or computer.

◆ Cost elements (see Table A-2)

► Development of a course objective and scope of training.

► Preparation and production of course material.

► Dedicated telephone line and speakerphone with microphone for audio conference.

► PC workstation and modem and communication software to link with main computer for computer conferencing.

► Satellite links, delivery, and installation of transmission/receiving equipment for video conferencing.

Table A-2.
Costs Associated with Teleconferencing

Cost elements	Cost
Audio conferencing	
Speakerphone with microphone	$2,000 – $2,500
Briefing or update development time	$25 – 40/hour
Instructor briefing time	$25 – 40/hour
Student time	$20 – 40/hour
Video conferencing	
Equipment	$50,000 – $70,000
Delivery, installation	$20,000
Support, maintenance	$10,000/year
Satellite segment	$55,000/year
Course development/presentation time	$25 – 40/hour
Student time	$20 – 40/hour
Computer conferencing	
Equipment (hardware and courseware)	$15,000 – $40,000
Course development	$25 – $40/hour
Instructor time	$25 – $40/hour
Student time	$20 – $40/hour

◆ *Number of personnel trained*

Limited by equipment such as PC workstations, available satellite segments, transmission/receiving equipment.

◆ *Equipment requirements*

Television (TV) monitors, cameras, satellite transmission equipment, work-stations with modems, and dedicated telephone lines.

◆ *Potential advantages*

► Audio conferencing

- Low-cost technology.

- Limited travel.

- Interactive.

- Available at numerous sites.

- Low trainee time off.

- Provides updates or refresher training in a timely fashion.

► Video conferencing

- Interactive.

- Low trainee time off.

- Provides access to refresher training.

- Can transmit from the field.

- Training can be received on site; limited travel.

- Some systems, e.g., Teletraining Network, costs are fixed so that video conferencing becomes more efficient the more it is used.

- Can use tapes, transparencies, and computer graphics.

- Multiple instructor access to audience.

- ► Computer conferencing

  - ♦ Low trainee time off.

  - ♦ Eliminates travel and per-diem costs.

  - ♦ Available at numerous sites including home and work.

  - ♦ Trainees can participate at their own pace.

- ♦ *Potential disadvantages*

  - ► Audio conferencing

    - ♦ Lack of visual presentation capability.

    - ♦ Scheduling is difficult.

    - ♦ Limited to briefings or updates.

  - ► Video conferencing

    - ♦ Initial high cost for equipment.

    - ♦ Complex logistics.

    - ♦ Scheduling can be difficult.

    - ♦ Trainees limited to size of classroom and monitoring screens.

  - ► Computer conferencing

    - ♦ Low social interaction.

    - ♦ Computer intimidation.

    - ♦ High cost for dedicated hardware.

VIDEOTAPE

Videotapes can be developed by a contractor and disseminated to end-user locations, or they can be developed in-house.

● *Cost elements (see Table A-3)*

► Development of a course objective and scope of training.

► Subject matter expert develops script.

► Scriptwriter approves or disapproves script and develops narrative.

► Production crew (narrator, actors, lighting, sound, camera crews, and director) begins filming.

► Editing.

► Equipment: television and videotape player.

► Costs associated with students being away from their normal work duties.

Table A-3.
Costs Associated with Videotape as a Training Method

Cost elements	Cost
Development of a course objective and scope of training	SME $80 – $100/hour
Script development by SME	Scriptwriter narrative $150/minute
Approval of script by scriptwriter	Production crew $500/day/crew member
Production crew	Narrator $200/day
Editing	Editing $250 – $300/hour
Equipment: television, videotape player	Television $250 – $3,000 Videotape player $150 – $500
Costs associated with students being away from their normal work duties	Student time $20 – $40/hour

Note: SME = subject matter expert

● *Travel requirements*

Contractor travel to production site.

- *Equipment requirements*

  TV and video player

- *Potential advantages*

  - ► Flexibility in training location and number of personnel trained.

  - ► Ability to reuse tape at minimal costs for additional training.

  - ► Effective visual aid to other training methods.

  - ► Inexpensive to produce and distribute to end users if done in-house.

  - ► Can be viewed at any time.

  - ► Bidders list available through educational television program coordinator.

  - ► Low trainee time off.

- *Potential disadvantages*

  - ► No interaction.

  - ► Expensive when contracted out ($1,000 – $2,000 per finished minute).

  - ► Does not permit random access.

  - ► Unsuitable when presenting a lot of factual information.

  - ► Upgrade, modification, or improvement to the system is difficult and expensive.

Computer Software Tutorial (Embedded Training)

Computer software tutorial training consisting of a range of activities from simple help assistance to a full-blown tutorial located within the main application software.

- *Cost elements (see Table A-4)*

    ► Development of training software package.

    ► Trainee time to install software and practice use of the main application program.

Table A-4.
Costs Associated with Computer Software Tutorial
(Embedded Training)

Cost elements	Cost
Development of training software package	Development costs specific for primary application software
Trainee time to install software and practice use of main application program	Additional costs for training software $5,000 – $20,000

- *Number of personnel trained*

    Limited to the availability of PCs with adequate memory.

- *Equipment requirements*

    PC workstation

- *Potential advantages*

    ► Eliminates travel and per-diem requirements.

    ► Allows reuse as a training method at no additional cost.

    ► Training is available when needed.

    ► Simplifies the logistics of providing training; delivered along with primary application program.

    ► Ability to enter/exit training method for assistance during actual data input.

- ► Provides the new user with immediate hands-on experience.

- ► Broad range of software available such as word processing, data base management, etc.

- ► Low trainee time off.

◆ *Potential disadvantages*

- ► Requires significant advanced planning.

- ► Memory or storage capacity limitations.

- ► Equipment availability for training.

- ► High development costs.

- ► Requires high level of design and programming expertise.

TRAIN-THE-TRAINER

In the train-the-trainer method, designated installation personnel attend resident training and become "in-house" trainers for other system users; this method is appropriate when more than one individual will input data or otherwise utilize data management systems.

● *Cost elements (see Table A-5)*

 ► Course development.

 ► Preparation/production of course material; handouts, transparencies, and manuals.

 ► Student costs: travel, lodging, per diem, and car rental.

 ► Instructor costs: travel, lodging, meals, and course instruction

 ► Classroom: heating and cooling, electrical lighting and power (indirect overhead for courses held off military installations).

 ► Equipment: PC workstations; rental or purchase

Table A-5.
Costs Associated with Train-the Trainer

Cost elements	Cost
Course development	Similar in scope to those costs associated with resident training as seen in Table A-1 However, total cost to installation for system training would be less under this method since total travel would be limited and an in-house trainer would have access to personnel requiring training at times convenient for all and could tailor training to installation-specific issues This would reduce time necessary to train designated personnel and reduce their time away from primary duties
Preparation/production of course material	
Student costs travel, lodging, per diem, and car rental	
Instructor costs travel, lodging, meals, and course instruction	
Classroom heating and cooling, electrical lighting, and power	
Equipment PC workstations, rental or purchase	

● *Number of personnel trained*

 ► Limited by available classroom space, billeting, course objective, and equipment.

 ► Optimum class will consist of students with same skill levels.

 ► Optimum student-to-instructor ratio: 20:1 to 30:1

- *Equipment requirements*

  - ► Two students per workstation.

  - ► Classroom equipment: PA system, desks and chairs, PC workstations, power connections to run PCs, and audio visual aids.

- *Potential advantages*

  - ► Eliminates travel and per-diem requirements for multiple personnel from same installation or Army major command (MACOM).

  - ► Installation has in-house trainer who can mold training to specific requirements pertinent to installation.

  - ► Ability to structure command-level briefings independent of outside sources of training.

  - ► Quick access for information; interactive.

  - ► Provide hands-on training in-house.

  - ► Training of new personnel can be accomplished in a timely manner.

  - ► Provides one central source for updating systems.

- *Potential disadvantages*

  - ► High costs for initial trainer instruction because of travel, per diem, and lodging.

  - ► May experience limited access to installation personnel requiring training.

  - ► Need to spend time away from primary duties to develop training plans and conduct training.

  - ► Loss of local trainer because temporary duty (TDY) status, transfer, or termination.

1-800 NUMBER HOTLINE

In this method, the system developer provides a means for responding to questions associated with the installation and use of any automated data management system. This method is primarily an adjunct to training that has already been conducted. It is similar to a help key but allows for contact with a system expert.

- *Cost element (see Table A-6)*

   Equipment: system developer maintains a toll-free hotline for automated data system (ADS) troubleshooting.

Table A-6.
Costs Associated with 1-800 Number Hotline

Cost element	Cost
Equipment Telephone system hotline	Cost to establish dedicated line and costs associated with volume use $25.00 order charge $51.50 connection charge $42.00 inside connection with phone jack $47.42 monthly charge $14.40 per hour use fee

- *Audience*

   All levels of the organizational structure.

- *Potential advantages*

   - Quick access and interaction with system experts.

   - Customer assumes no cost; system developer provides the service.

   - Available for all users.

   - Can be integrated with other training methods.

   - Can be used for limited updating or modification of system capabilities. This verbal communiqué should be followed-up with user manual modification.

♦ *Potential disadvantages*

► System may be overwhelmed especially after introduction of new data management systems or modification of existing systems.

► Limited in scope of help provided given verbal nature of communication.

► Access to system may be limited due to communication system downtime due to malfunction, time zone differences, or inability to consistently provide expert advice when needed.

DECENTRALIZED VENDOR

In this method, local contractors at the end-user locations are contracted to develop training methods. ADS developers may in some cases perform this role.

♦ *Cost elements (see Table A-7)*

▶ Development of a course objective and scope of training.

▶ Preparation and production of course material.

▶ Instructor costs: travel, lodging, meals, and course instruction.

▶ Equipment: PC workstations; rental or purchase.

Table A-7.
Costs Associated with Decentralized Vendor Training

Cost elements	Cost
Development of a course objective and scope of training Preparation/production of course material Instructor costs travel, lodging, meals, and course instruction Equipment: PC workstations, rental or purchase	Development costs similar to those associated with resident training. Student travel and per diem is not a factor in this training method

♦ *Number of personnel trained*

▶ Limited by the availability of classroom space.

▶ Limited by the availability of workstations.

▶ Student/instructor ratio: 20:1 - 30:1.

♦ *Equipment requirements*

▶ Two students can share a workstation.

▶ Classroom: PA system, desks and chairs, PC workstations, power connections to run PCs, and audiovisual aids.

- *Potential advantages*

    On-site trainer provides end user with flexibility in scheduling.

    ► Training personnel within same organization or MACOM more effective than class with organizational mix.

    ► Interactive training method.

    ► Limited trainer travel.

- *Potential disadvantages*

    ► Continuity of training Army-wide may be disrupted.

    ► Trainers may not be able to respond to Army-specific issues.

    ► Classes could be disrupted by students responding to normal duty requirements during the course of training.

    ► Class size may be too small to be cost-effective.

    ► Installation unable to make available all potential users because of time and organizational constraints.

PROGRAMMED TEXT

In this method, the contractor creates text that provides guidance for ADS users, and a series of quizzes in the text tests effectiveness of training.

- *Cost elements (see Table A-8)*

    - Development of text

    - Dissemination of programmed text

Table A-8.
Costs Associated with Programmed Text

Cost elements	Cost
Development of text	$80 – $100/hour
Dissemination of text	$75 – $150/text

- *Equipment requirements*

    PC workstation

- *Potential advantages*

    - Training conducted in-house, no travel.

    - Distribution costs relatively low.

    - End user possesses a source document at the end of training.

    - No limitations in class size.

    - Training self-paced.

- *Potential disadvantages*

    - Not interactive.

    - Difficult to track or record student progress.

    - Distractions from work environment.

ON-THE-JOB TRAINING

On-the-job training offers a practical hands-on application. This method is normally associated with train-the-trainer method for providing ADS training.

♦ *Cost element (see Table A-9)*

Equipment: PC workstations

Table A-9.
Costs Associated with On-the-Job Training

Cost element	Cost
Equipment PC workstations	$10,000 – $50,000

♦ *Potential advantages*

➤ Real-world application, using actual numbers, generating reports, performing queries, etc.

➤ Ability to identify idiosyncrasies in the system during training, something not typically identified in other training methods.

➤ Creates excellent familiarity with system.

➤ No travel requirements.

➤ Self-paced training.

♦ *Potential disadvantages*

➤ Not interactive.

➤ Long training period; difficult to assess progress.

➤ Can reach impasse of hardware or software nature.

➤ Requires good PC skills.

CORRESPONDENCE COURSE

Correspondence courses are typically prepared and administered by the Army Institute for Professional Development.

◆ *Cost elements (see Table A-10)*

► Development of a course.

► Printing course books.

► Disseminating course to end users.

► Contractor or assisted development costs.

► Modification of course materials.

Table A-10.
Costs Associated with Correspondence Course

Cost elements	Cost
Development of a course Printing course books Dissemination of training method to end users Contractor or assisted development costs	$28/student/year to administrator. (This does not include course development)

◆ *Travel requirements*

None

◆ *Potential advantages*

► Feedback provided by completion notice.

► Low cost to update.

► User possesses a source document for referencing.

► Self-paced.

► "Stand-alone" document; appendices contain abstracts.

► Can be sent anywhere.

- ► Progress of student recorded.

- ► Can mix computer-aided instruction with text.

- ◆ *Potential disadvantages*

  - ► May not provide training "when needed."

  - ► Not interactive.

STAFF BRIEFING

This method consists of using a centralized briefing prepared by a single contractor who travels to individual installations to present it, primarily to installation staff.

◆ *Cost elements (see Table A-11)*

  ► Development of briefing.

  ► Instructor costs: travel, lodging, per diem, and briefing time.

Table A-11.
Costs Associated with Staff Briefing Method

Cost elements	Cost
Development of briefing	Development of briefing: $25 – $50/hour
Instructor costs: travel, lodging, per diem, and briefing time	Travel, lodging, per diem similar to those associated with resident training costs. Presentation time cost: $25 – $50/hour

◆ *Location of training*

Instructor travels to installation.

◆ *Number of personnel trained*

Limited by classroom or conference space.

◆ *Potential advantages*

  ► Briefing tailored to audience.

  ► No student travel.

  ► Appropriate for staff- or command-level briefings.

  ► Can be videotaped for distributed training.

- *Potential disadvantages*

  - No hands-on instruction provided.

  - Provides only an overview of existing or newly fielded automated data systems.

  - Limited in scope.